

# PATENT ABSTRACTS OF JAPAN

(11)Publication number : 10-032897

(43)Date of publication of application : 03.02.1998

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(51)Int.Cl.

H04R 9/04

H04R 9/04

C09D 5/00

C09D 11/00

C09D183/04

H04R 31/00

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(21)Application number : 08-184565

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(22)Date of filing : 15.07.1996

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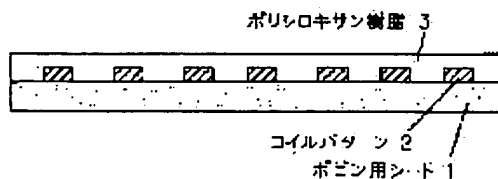
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## (54) ACOUSTIC VOICE COIL AND ITS PRODUCTION

(57)Abstract:

PROBLEM TO BE SOLVED: To provide a thin voice coil which excels in the heat resistance at a low production cost by forming an insulating coat on the surface of a material, where a coil pattern is printed with use of the conductive resin by coating the heat resisting resin.

SOLUTION: A coil pattern 2 is printed on the surface of a bobbin sheet 1 and the polysiloxane group heat-resisting resin is thinly coated over the pattern 2. Thus, an insulating coat is formed on the surface of the sheet 1. The materials of a voice coil bobbin include a ceramic film or such materials as aluminum, titanium, a magnesium alloy, etc. Furthermore, the voice coil bobbin can use the materials of organic films, having high heat resistance such as polyimide, polyether sulfone, polyether imide, etc. Thus, the pattern 2 is printed on the coating of the polysiloxane group heat resisting resin, and the surface of the sheet 1 is coated by resin. In this way, a material having a multilayer structure can be easily obtained.



## DETAILED DESCRIPTION

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[Detailed Description of the Invention]

[0001]

[Field of the Invention] This invention relates to the manufacture approach of the voice coil used for sound output devices, such as a loudspeaker, etc., the voice coils used for a general-purpose electrical machinery and apparatus, and these voice coils.

[0002]

[Description of the Prior Art] In recent years, in the audio related industry, the loudspeaker as a sound output device is further expected quality[ of loud sound ]-izing, and a high increase in power rather than before with digitization of a playback music source.

[0003] In high power loudspeakers, such as a loudspeaker for monitors, since a high current flows to a voice coil at the time of use, voice coil temperature also becomes hundreds of degrees C, the insulating material and adhesives with which the copper wire which is the member of a voice coil was coated deteriorate with generating heat, and this has become causes, such as short one between copper wire, or \*\*\*\*\* of a wire rod. Moreover, since that the cross section of a coil line is circular, a coat layer, and the layer of adhesives are thick, the consistency of the wire rod per unit volume falls, and it is forced a big limit by the magnetic gap for acquiring sufficient magnetic flux, and \*\*\*\* of a coil on a design.

[0004] Moreover, although a voice coil makes copper wire a suitable wire size, and it is manufactured through a series of processes of winding around a bobbin and carrying out heat hardening of the adhesives after carrying out coat processing, the present condition is taking much time amount cost not only to start, but to result [ from a raw material ] in an end product in each process, since the expensive facility is required.

[0005]

[Problem(s) to be Solved by the Invention] The insulating coating agent of the copper wire which is the wire rod for voice coils used conventionally [ many ] Since thermal resistance is low since organic system ingredients, such as a varnish, are used, and the organic system ingredient is similarly used about the adhesives of a voice coil bobbin and a coil, In a loudspeaker with indispensable high power, such as a loudspeaker for monitors, the organic system ingredient used as the insulating material and adhesives of a voice coil will deteriorate with the heat generated inside, and, thereby, phenomena, such as short-circuit between copper wire and \*\*\*\*\* of a coil, will arise.

[0006] Thus, even if neodium magnets which improved farther [ flux density ] than the former, such as a composite-material diaphragm, a rubber edge, etc. whose endurance ability improved remarkably compared with the paper pulp diaphragm and cloth edge which the capacity as a loudspeaker will be restrict and have be conventionally use by the heat generate inside a loudspeaker, are use for the conventional voice coil for loudspeakers, the present condition is being unable to demonstrate the engine performance to a limit. Moreover, the facility with the production process of the conventional voice coil expensive to each process processing is needed, and the cost cut for it is also demanded.

[0007]

[Means for Solving the Problem] without the coat of a wire rod deteriorates according to generating of heat and this invention short-circuits in view of the above-mentioned technical problem -- degradation of adhesives to a wire rod -- rose \*\*\*\* -- there are nothings, i.e., it excels in thermal resistance, and thin shape-ization is enabled, and it aims at offering the voice coil which simplified the production process further and realized the cost cut.

[0008] In order to attain this purpose, the 1st configuration of the voice coil for sound of this invention is characterized by having used electric conduction resin, having printed the coil pattern, having carried out thin layer coating of the polysiloxane system heatproof resin resin to the front

face, and making an insulating coat form in the material front face which constitutes a coil bobbin.  
[0009] Moreover, the 2nd configuration of the voice coil for sound of this invention is characterized by making multilayer structure of a coil possible by using electric conduction resin, printing a coil pattern, carrying out thin layer coating of the polysiloxane system heatproof resin to a front face, making an insulating coat form in the material front face which constitutes a coil bobbin, and printing a coil pattern from on a coat further.

[0010] In the voice coil for sound of the 1st configuration, after [ for which the manufacture approach of the voice coil for sound of this invention was described above ] printing a coil pattern on a strip-of-paper-like sheet, it is characterized by having rolled this sheet in the shape of a cylinder, and making it form in a bobbin configuration.

[0011] Moreover, the manufacture approach of the voice coil for sound of this invention rotates the above-mentioned bobbin ingredient fabricated in the shape of a cylinder in the voice coil for sound of the 2nd configuration so that the core of the cylinder of a bobbin may serve as a shaft, and it is characterized by carrying out pattern printing by making electric conduction resin slide to said revolving shaft and parallel on said material front face.

[0012] Moreover, the manufacture approach of the voice coil for sound of this invention is characterized by the above-mentioned thing for which the coil pattern was printed to both sides of a bobbin ingredient, and multilayer structure was accomplished in the voice coil for sound of the 2nd configuration.

[0013] Moreover, the voice coil for sound of this invention is characterized by using a thin film sheet made from the ceramics for the bobbin for voice coils in addition to the 2nd configuration of the voice coil for sound.

[0014] Furthermore, the voice coil for sound of this invention is characterized by making the insulation of the coil and metal bobbin by which used metal sheets, such as aluminum, titanium, and a Magnesium alloy, for the voice coil bobbin material, carried out thin layer coating of the polysiloxane system heatproof resin on this sheet, and pattern printing was carried out with electric conduction resin hold, in order to raise rigidity and reinforcement in addition to the 2nd configuration of the above-mentioned voice coil for sound.

[0015] Furthermore, in addition to the 2nd configuration of the above-mentioned voice coil for sound, the voice coil for sound of this invention is characterized by using heat-resistant organic high system films, such as polyimide, polyether sulphone, and polyether imide, for a voice coil bobbin as a material.

[0016]

[Embodiment of the Invention] Into the ingredient which constitutes a voice coil bobbin, the voice coil for sound of this invention prints the coil pattern 2 on the front face of the sheet 1 for bobbins, as shown in the sectional view of drawing 1 , carries out thin layer coating of the polysiloxane system heatproof resin shown that it covers the coil pattern 2 by (\*\* 1) on a front face, and has the composition of having made the insulating coat forming. Metals, such as a ceramic system film, aluminum and titanium, and a Magnesium alloy, are used for a voice coil bobbin ingredient. Moreover, heat-resistant organic high system films, such as polyimide, polyether sulphone, and polyether imide, can be used for a voice coil bobbin as a material.

[0017]

[Formula 1]

[0018] Moreover, a material with multilayer structure as shown in the sectional view of drawing 2 can be easily obtained by having carried out the coat of the polysiloxane system heatproof resin, printing a coil pattern further and turning resin coating of the front face like the above up.

[0019] In order to raise the rigidity and thermal resistance of a voice coil bobbin, when a metal sheet is used as a bobbin material, as shown in the sectional view of drawing 6, by carrying out the coat coat of the polysiloxane system heatproof resin 3 beforehand to the metal sheet 4, insulation is made to hold and the short-circuit between lines is prevented. Then, the bobbin material which used the metal sheet for the bobbin ingredient and gave the coil pattern is obtained by printing the coil pattern 2 with electric conduction resin, and coating a front face with polysiloxane resin. As mentioned above, drawing 1, drawing 2, and drawing 6 are the sectional views of the sheet in which the laminating was carried out by the operation gestalt of this invention, and drawing 3 is the top view (schematic drawing) which looked at the sheet with which such pattern printing was performed from the upper part.

[0020] The sheet of the shape of a strip of paper as shown in drawing 3 is wound around a cylindrical shape as shown in drawing 4, the endpoint A on drawing 3, and a, B and b are connected electrically, and a coil pattern performs pattern wiring which functions as a coil. It is both ends (\*1), and (\*2) is led to a terminal. In using it as an actual voice coil, it adjusts a number of turns so that a predetermined impedance may be obtained.

[0021] As the printing approach of a pattern is shown in the bobbin ingredient 5 of the shape of a strip of paper as shown in drawing 3 at the approach of printing at once by screen-stencil, and drawing 5 The core of a cross-section circle is rotated for the bobbin ingredient 6 fabricated in the shape of a cylinder as a shaft 8, and two kinds of an approach which are made to slide electric conduction resin for a pen 7, a brush or a blasting machine, etc. up and down in parallel with said center-of-rotation shaft, and draw the coil pattern 2 can be considered.

[0022] Furthermore, it is more convenient at the time of connection between the above-mentioned terminal and a printed circuit board to attach the endpoint (\*1 in drawing 3 and drawing 4, \*2) for leading to a terminal in the same direction in the vertical location of a coil, in order to use it as an actual voice coil. For this reason, in screen-stencil, after printing a pattern 9 on a side front first, it connects electrically so that a pattern 10 may be printed also at the rear face and an endpoint may become in this direction ( drawing 7 ). In this case, electric association on the rear face of surface is performed by endpoint C-c at drawing 7.

[0023] Moreover, when printing by making it rotate, it is made multilayer structure as drawn the same coil pattern on both sides, or carried out the insulating coat coat of one side by polysiloxane system heatproof resin and shown in drawing 2, and an endpoint is made to come in this direction.

[0024] According to this configuration, an electrical conducting material is used for the voice coil bobbin which has thermal resistance, a coil pattern is printed, but metaled impalpable powder fixes, and in order to combine with the bobbin material front face which is the fixed body physically, it is very hard to produce exfoliation. Therefore, the phenomenon of \*\*\*\*\* of the wire rod with which melting of the adhesives by heat and degradation serve as a trigger as compared with what was performing a conventional wire rod and a conventional bobbin with

organic system adhesives does not arise. Moreover, it has a predetermined opening, and is arranged, organic coating deteriorates in the repeat of expansion of the metal wire by heat, and the printed coil is released also from the phenomenon peculiar to the conventional coil of causing short-circuit.

[0025] In manufacturing this voice coil, using a screen-stencil technique, many voice coils are obtained at once and the mass production in a short time is attained very much by printing a coil pattern. After printing is pierced in the shape of a strip of paper, and it becomes completion of a voice coil by winding in the shape of a cylinder.

[0026] It is possible to raise thermal resistance more by using metals, such as a ceramic system film, aluminum and titanium, and a Magnesium alloy, for a voice coil bobbin ingredient, using the polysiloxane system heatproof resin of an inorganic system as a coat ingredient. When a metal is used for a bobbin, after carrying out pre-insulation to a front face by polysiloxane system heatproof resin first, an electrical conducting material is printed.

[0027] By performing insulating coat processing by polysiloxane system resin, compared with the organic macromolecule insulation coat represented by the conventional SV varnish etc., thin film-ization can be realized more, and it can combine with thickness reduction of a coil, and thermal resistance not only improves, but it can reduce the thickness of the whole voice coil. Therefore, it becomes possible to design the magnetic gap in a magnetic circuit narrowly, and the efficiency of a loudspeaker can be increased with improvement in flux density.

[0028] By the above, by pulling out to a limitation the engine performance of other members, such as a diaphragm which constitutes them for the engine performance of the loudspeaker conventionally restricted by the heat-resistant limitation of a voice coil, an edge, and a magnetic circuit, it excels in an acoustic feature and the engine performance of the voice coil itself not only improves, but can obtain the loudspeaker of high power.

[0029]

[Example]

(Example 1: Creation of a coil) It is the line breadth of 500 micrometers about a coil pattern to the film (100 micrometers in thickness) which fabricated the polyimide of the ingredient used as a coil bobbin to the cylindrical shape. 20 micrometers in thickness An electric conduction silver paste is used by 100 micrometers between lines. As shown in drawing 3, polysiloxane resin is applied to what carried out pattern printing in a coil pattern printing side for insulating coat processing, and it is 100 degrees C after desiccation and with a thermostat. What was left for 1 hour was used as the coil.

[0030] Table 1 It was comparing the result of this this example with the voice coil by the copper wire of 0.22mm of wire sizes using the conventional SV varnish as an insulating coat in heat-resistant temperature and thickness, and a predominance was checked in the above-mentioned engine performance of this example article.

[0031]

[Table 1]

[0032] (Example 2: Creation of a voice coil) It is the line breadth of 500 micrometers about a coil pattern to the film (100 micrometers in thickness) which fabricated the polyimide of the ingredient used as a voice coil bobbin to the cylindrical shape. 50 micrometers in thickness By 10 micrometers, the coil pattern was printed between lines, using an electric conduction silver paste as about 10mm of \*\*\*\*.

[0033] After printing from the right end of a coil to a left end and processing at 200 degrees C for 1 hour, before turning up, it leaves the last edge (left end) and polysiloxane system heatproof resin is applied, and it was left for 1 hour and made to harden at 100 degrees C with a thermostat after desiccation. Same processing was performed at every clinch and two round trips [ 80 ] were printed. Finally, polysiloxane resin was applied to the coil pattern printing side for insulating coat processing, and what was left at 100 degrees C with the thermostat for 1 hour was used as the voice coil after desiccation.

[0034] Table 2 It was comparing the result of this this example with the voice coil by the copper wire of 0.22mm of wire sizes using the conventional SV varnish as an insulating coat in heat-resistant temperature, thickness, and efficiency (sound pressure), and a predominance was checked in the above-mentioned engine performance of this example article.

[0035]

[Table 2]

[0036]

[Effect of the Invention] As mentioned above, since the voice coil for sound by this invention eliminated organic system adhesives and the organic system insulation coat which had the possibility of the degradation destruction by heat by having used the electrical conducting material for the ingredient which constitutes a coil bobbin, having printed the coil pattern, having carried out thin-layer-coating processing of the polysiloxane resin which has thermal resistance on the front face of the ingredient by which pattern printing was carried out, and having made the insulating coat form, its thermal resistance improves compared with the conventional coil.

[0037] Moreover, since many precise patterns can be drawn on coincidence by screen-stencil, a lot of production is once attained at a process.

[0038] Furthermore, thin-film-izing is easy for the polysiloxane which is tough resin, and on metal bobbins, such as aluminum used in order to raise thermal resistance, it can make an insulating coat able to form and can be used. It becomes unnecessary thereby, to choose a bobbin only within the thing of a nonmetal for electric conduction resin printing.

[0039] Moreover, it is possible to perform printing by the electrical conducting material further, and to make the multilayer structure of a coil form on pellicular resin, and densification of a coil is attained.

[0040] The above enabled it to raise thermal resistance, thin-shape-izing, and the efficiency in a magnetic circuit compared with the conventional voice coil.